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TSUNAMI WARNING CENTER OPERATIONS

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1. West Coast/Alaska Tsunami Warning Center (WC/ATWC).

1.1. General. The WC/ATWC, located at Palmer, Alaska, has the primary responsibility for the detection, location, and determination of magnitude of potentially tsunamigenic earthquakes occurring in the coastal areas of Alaska, British Columbia, Washington, Oregon, and California. It is responsible for the preparation and dissemination of tsunami warning, watch, advisory, and information bulletins to civilian and military officials in Alaska, British Columbia, Washington,

Oregon, and California regardless of epicentral location. It has secondary responsibility for the detection and evaluation of earthquakes located outside its regional AOR. Copies of tsunami warning logs will be transmitted to the Tsunami Program Manager and WSH for all events resulting in the dissemination of tsunami watches and warnings.

1.1.1. Housing. Because the WC/ATWC must react to earthquakes 24-hours a day, its duty personnel are required to live within a specified travel time of the Center.

1.2. Operations. As the Regional Tsunami Warning Center for Alaska, British Columbia, Washington, Oregon, and California, WC/ATWC will operate in accordance with the following procedures. For earthquakes occurring:

1.2.1 Near the Pacific coasts of Alaska, British Columbia, Washington, Oregon, and California. For initially determined magnitudes greater than 7.0 but less than or equal to 7.5, the WC/ATWC will issue a tsunami warning covering an area within a 2-hour wave travel time from the time of bulletin issuance and a tsunami watch extending one additional hour of wave travel time. For initially determined magnitudes greater than 7.5, a tsunami warning will be issued covering an area within a 3-hour wave travel time from the time of bulletin issuance and a tsunami watch extending an additional 3-hour wave travel time. Subsequent bulletins will be issued at least hourly until the warning is cancelled or a final warning supplement is issued. All watch and warning areas will be described using the breakpoints shown in section 1.2.5 below.

1.2.2 Alaska's Bering Sea. For initially determined magnitudes greater than 7.0, a tsunami warning will be issued covering St. Paul and St. George Islands and the Aleutian Islands (Attu to False Pass). There will be no watch area and the warning area will not be expanded, even if a significant tsunami is detected. Subsequent bulletins will be issued at least hourly until the warning is cancelled or a final warning supplement is issued.

1.2.3 Elsewhere in the Pacific Basin. For initially determined magnitudes greater than 7.5, the WC/ATWC, after coordinating with the PTWC, will:

(a) When any part of the WC/ATWC AOR is within 6 hours tsunami travel time from the epicenter, except when the epicenter is along the coast of Mexico or Central America, issue a tsunami warning covering an area within a 3-hour wave travel time from the time of bulletin issuance and a tsunami watch extending another 3 hours travel time. All warning and watch areas will be described using the breakpoints in paragraph 1.2.5 below or,

(b) When the epicenter is more than 6 hours tsunami travel time distant from any part of the WC/ATWC AOR the WC/ATWC will issue a Tsunami Advisory Bulletin.

(c) Subsequent bulletins will be issued at least hourly until the warning or advisory is cancelled or a final warning supplement is issued.

1.2.4 Tsunami Information Bulletins. WC/ATWC will issue a Tsunami Information Bulletin whenever an earthquake with a magnitude of 6.5 or greater, but below the watch/warning thresholds described in sections 1.2.1 and 1.2.2 above, occurs within its AOR. WC/ATWC, after coordination with PTWC, will issue a Tsunami Information Bulletin for their AOR whenever an earthquake with a magnitude from 6.5 to 7.5 occurs in the Pacific basin, but outside of the WC/ATWC AOR.

1.2.5 Breakpoints. When issuing tsunami watches/ warnings, the following breakpoints will be used to define the extent of the watch or warning:

Attu, AK	Cape Flattery, WA
Adak, AK	Point Grenville, WA
Nikolski, AK	Clatsop Split, OR
Dutch Harbor, AK	Cascade Head, OR
Sand Point, AK	Cape Blanco. OR
Kodiak, AK	Oregon-California Border
Seward, AK	Cape Mendocino, CA
Yakutat, AK	Point Sur, CA
Sitka, AK	Point Conception, CA
Langara Island, BC	California-Mexico Border
Northern Tip Vancouver Island, BC	Point Arena, CA

Whenever the boundary of a watch or warning lies between two breakpoints, the watch or warning will be extended to, and include, the next breakpoint.

1.2.6. Backup of PTWC. In the event that PTWC is disabled so that it is unable to issue any of its critical products, WC/ATWC will issue those products on its behalf using the PTWC product identifiers.

2. Richard H. Hagemeyer Pacific Tsunami Warning Center (PTWC).

2.1. General. The PTWC, located at Ewa Beach, Oahu, Hawaii, has the responsibility for the detection, location, and determination of magnitudes for earthquakes occurring anywhere in the Pacific Basin. If these earthquakes are potentially tsunamigenic, PTWC prepares tsunami warning, watch, advisory and information bulletins and disseminates them, exclusive of the WC/ATWC AOR, to the appropriate U.S. civil, U.S. military, and foreign government concerns throughout the Pacific basin.

2.1.1. Housing. Because the PTWC must react to earthquakes 24-hours a day, its duty personnel are required to live on the Center grounds when adequate Government housing is available or to live within a specified travel time of the Center.

2.2. Operations. As the Regional Tsunami Warning Center for Hawaii, the National Tsunami Warning Center for the United States, and the International Tsunami Warning Center for the Pacific, PTWC will operate in accordance with the following procedures.

2.2.1. Regional Warning Center for Hawaii. For any earthquake occurring in the vicinity of the Hawaiian Islands, with an initially determined magnitude greater than 6.8, PTWC will issue a tsunami warning for the Hawaiian Islands in conformance with procedures coordinated with, and approved by, the Hawaii State Civil Defense. Subsequent bulletins will be issued at least hourly until the warning is cancelled or a final warning supplement is issued.

2.2.2. National Tsunami Warning Center. As the National Tsunami Warning Center for the United States, the PTWC is responsible for the detection of tsunamis which threaten U.S. interests throughout the Pacific Basin. For any earthquake with an initially determined magnitude greater than 7.5 but less than or equal to 7.8, the PTWC, for areas excluding the WC/ATWC AOR, will issue a tsunami warning covering coastlines within 1000 kilometers of the epicenter. This fixed-area warning will continue, with supplements issued at least hourly, until data are received to warrant a cancellation, a final warning supplement, or under extraordinary circumstances an upgrade to an expanding warning and watch or a Pacific-wide warning. For any earthquake with an initially determined magnitude greater than 7.8, the PTWC, for areas excluding the WC/ATWC AOR, will issue a tsunami warning covering an area within a 3-hour tsunami wave travel time from the time of bulletin issuance with a tsunami watch extended for the 3- to 6-hour tsunami wave travel time. The areas covered by the tsunami warning and watch will be expanded at least hourly with subsequent bulletins until data are received to warrant a cancellation, a final warning supplement, or an upgrade to a Pacific-wide warning. Close coordination between WC/ATWC and PTWC is of utmost importance to avoid conflicting bulletin information.

2.2.3. International Tsunami Warning Center. The PTWC serves as the operational control center for the TWS of the Pacific. For any earthquake with an initially determined magnitude greater than 7.5 but less than or equal to 7.8, the PTWC, for areas excluding the WC/ATWC AOR, will issue a tsunami warning covering coastlines within 1000 kilometers of the epicenter. This fixed-area warning will continue, with supplements issued at least hourly, until data are received to warrant a cancellation, a final warning supplement, or under extraordinary circumstances an upgrade to an expanding warning and watch or a Pacific-wide warning. For any earthquake with an initially determined magnitude greater than 7.8, the PTWC, for areas excluding the WC/ATWC AOR, will issue a tsunami warning covering an area within a 3-hour tsunami wave travel time from the time of bulletin issuance with a tsunami watch extended for the 3- to 6-hour tsunami wave travel time. The areas covered by the tsunami warning and watch will be expanded at least hourly with subsequent bulletins until data are received to warrant a cancellation, a final warning supplement, or an upgrade to a Pacific-wide warning. These bulletins will be disseminated to the international participants as outlined in the Communications Plan for the Tsunami Warning System (COMM PLAN).

2.2.4. Tsunami Information Bulletin. For earthquakes below the magnitude thresholds in sections 2.2.2 and 2.2.3 above but magnitude 6.5 or greater, PTWC will issue a Tsunami Information Bulletin. PTWC may also issue a Tsunami Information Bulletin for certain earthquakes above magnitude 6.5, that don't pose a tsunami threat in the Pacific Basin either because they are located inland, or in a marginal sea, or are too deep.

2.2.5. Backup of WC/ATWC. In the event that WC/ATWC is disabled so that it is unable to issue any of its critical products, PTWC will issue those products on its behalf using the WC/ATWC product identifiers.

3. WC/ATWC - PTWC Coordination. Given the Pacific-wide impact of some tsunami events, and that the two Centers may be responsible for different aspects of the same earthquake, timely coordination between WC/ATWC and PTWC is essential for the overall effectiveness of tsunami services. Earthquake parameters will usually be refined through coordination between warning centers, and when available, using data from the National Earthquake Information Center (NEIC). The threshold for coordination will be magnitude 6.5.

3.1. Events within a Regional AOR. As Regional Tsunami Warning Centers, both WC/ATWC and PTWC are singularly responsible for the initial tsunami bulletin for earthquakes with epicenters located within their respective regional AORs. The initial bulletin should be disseminated within 15 minutes of the earthquake origin. All subsequent bulletins issued by each Center will be fully coordinated, that is, issued immediately after coordination, contain a common evaluation, and reflect the actions being taken by the other Center.

3.2. Events outside both Regional AORs. When the WC/ATWC and PTWC are both issuing bulletins for earthquakes whose epicenters are located outside of their regional AORs the initial and all subsequent Warning, Watch, Advisory, or Information Bulletins will be fully coordinated before issuance by EITHER Center. Bulletins for earthquakes located outside both regional AORs will generally be issued within 10 minutes of receipt of data necessary to characterize the earthquake.

3.3. Disagreements. In cases of disagreement:

a. The determination of the location and magnitude to be used in the bulletins is the responsibility of the Center in whose AOR the epicenter is located.

b. The decision as to whether to issue or cancel a watch/warning bulletin for its AOR is the responsibility of each Center.

3.4. Content and Format. Bulletin content and format will be as specified in the COMM PLAN.

4. Seismic Information Exchange and Dissemination. The NEIC, located in Golden, Colorado, as part of the U.S. Geological Survey, has the United States national responsibility for disseminating information on earthquakes occurring worldwide. The NWS tsunami program, except in response to tsunamigenic and potentially tsunamigenic earthquakes, and in cases where informative messages are necessary to prevent unneeded evacuations (i.e., strongly felt coastal earthquakes), will generally not disseminate or directly answer inquiries for seismic information. Separate from the exchange of information between Centers and with the NEIC, the WC/ATWC and PTWC will adhere to the following policy on the dissemination of seismic information:

a. For tsunamigenic or potentially tsunamigenic earthquakes, no restrictions exist on the exchange of seismic data with any observatory.

b. For non-tsunamigenic earthquakes with epicenters located outside the Center's regional area of responsibility, inquiries from the news media or civil/military emergency service authorities will be referred to the NEIC.

c. For non-tsunamigenic earthquakes with epicenters located within the Center's regional area of responsibility (usually magnitude 4.0 or greater or those with felt reports), information about the earthquake that is disseminated to the news media or civil/military emergency service authorities will also be transmitted to the NEIC duty geophysicists at the time of release.

d. For non-tsunamigenic earthquakes, all requests from foreign agencies for data will be referred to the NEIC.

5. Earthquake Seismology. The primary method of detecting and evaluating earthquakes is through a network of seismic stations. WC/ATWC and PTWC receive seismic data from a network of stations operated by the NWS and by other domestic and foreign governments and cooperating agencies. Seismic data are transmitted to the warning centers through various telemetry channels. These data allow WC/ATWC and PTWC to locate and size an earthquake, and therefore, determine the earthquake's potential for tsunami generation.

6. Sea Level Data. Sea level stations in the TWS are operated by the NWS and by a wide variety of domestic and foreign agencies. These stations detect tsunamis by recording the unusual changes in sea level that tsunamis produce. Data from some of the stations are telemetered continuously in real time to the warning centers. Others send their data when requested or on their own initiative if a tsunami is detected. Other stations have their data relayed in near real time via the U.S. Geostationary Operational Environmental Satellite (GOES) and the Japanese Meteorological Satellite (GMS). The National Ocean Service operates and maintains the Next Generation Water Level Measurement System which also transmits tide data over GOES.

7. Dissemination. Dissemination agencies provide the last vital link between the TWS and the public. Dissemination agencies have the responsibility for evaluating the tsunami information

received from the warning centers, for educating the public as to the danger of tsunamis and for developing those procedures that must be taken to avoid loss of life and property. Within the U.S., state civil defense agencies and the NWS have joint responsibility for passing tsunami watch, warning, advisory, and information bulletins to the public. Where feasible, NOAA Weather Radio will be used to relay tsunami information. Regional headquarters will provide guidelines for such usage within their AOR.

8. Communications Plan for the Tsunami Warning System. The COMM PLAN for the TWS serves as the operations manual for participants in the TWS.

8.1. Description. The COMM PLAN provides a general overview of the nature of tsunamis and a brief history of the warning service. It lists the sea level and seismograph stations which participate in the service, methods of communication between the stations and the tsunami warning centers, and gives examples of tsunami bulletin formats and content.

All countries that may be affected by tsunami generated in the area covered by the TWS, including all key United States participants, are listed by section in the COMM PLAN. These sections detail the methods by which various tsunami bulletins are sent and received. Sample bulletins and the criteria under which they are issued are also included.

A separate appendix to the COMM PLAN discusses the WC/ATWC stating the criteria under which its watches and warnings are issued and its communications methods.

8.2. Responsibility. PRH is responsible for the preparation and dissemination of the COMM PLAN and coordinating its preparation and update between WC/ATWC and PTWC. It will be routinely updated each year in January and July.